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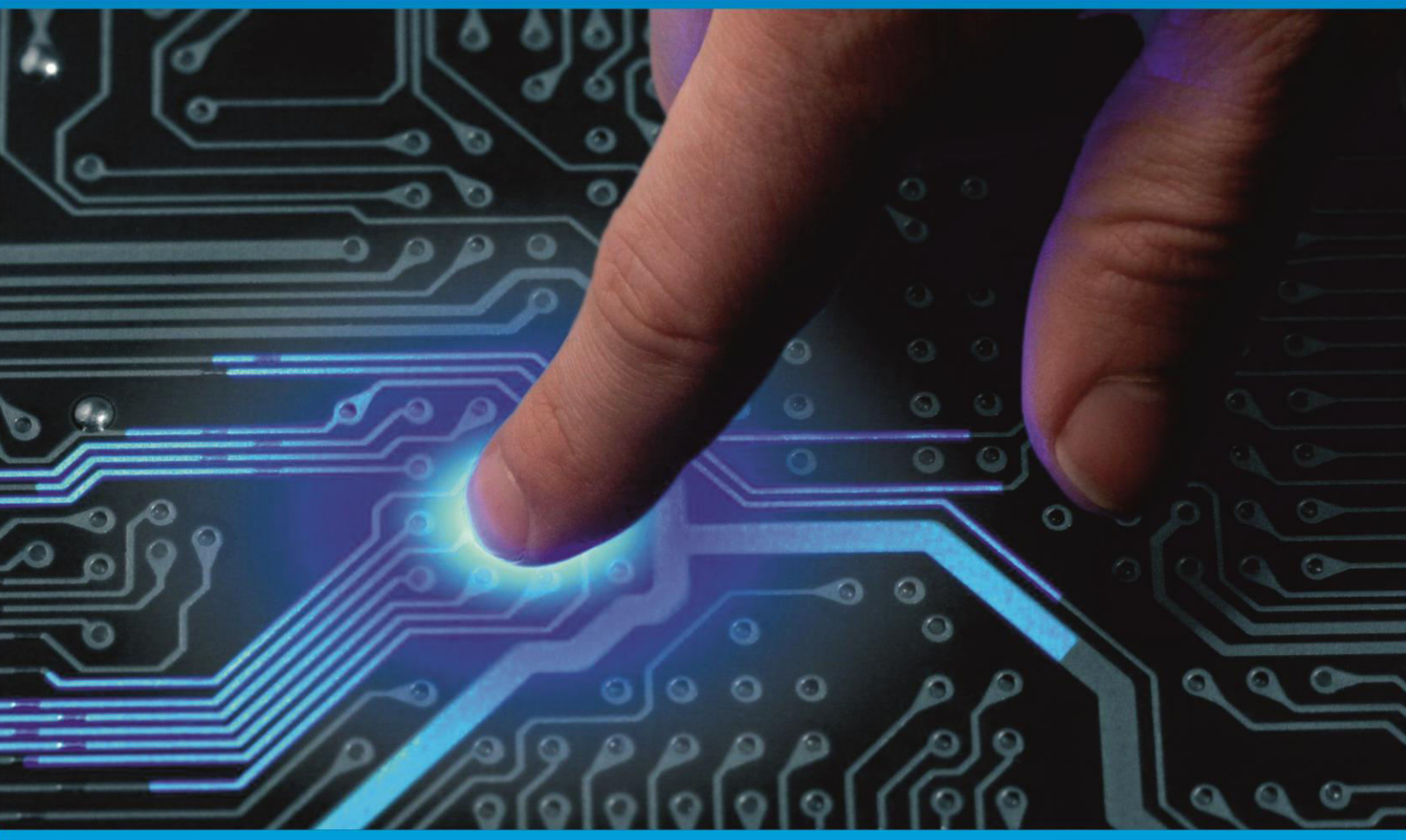

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Algo-Trading Using Candle-Stick Indicator

Kumar Divyam, Raj Kamal, Prakhar Agarwal, Satyam Kumar, DR. J. Girija

UG Student, Department of Computer Science and Engineering, Bangalore Institute of Technology, Bengaluru, India

HOD & Professor, Department of Computer Science and Engineering, Bangalore Institute of Technology, Bengaluru, India

ABSTRACT: Execution of trades on stock exchanges based on predefined criteria and without any human intervention using computer programs and software is called algorithmic trading or algo trading. In stock market terminology, algos are software programs that can collect data for a trading strategy, back-test the strategy and automatically trade whenever the strategy generates a buy or sell signal. For example, if we use a simple strategy to buy a stock if the stock price goes above its 20-day moving average and sell if it goes below the moving average. If we don't use a program, we will have to manually look at the charts and then track the charts for the buy and sell signals. Doing this manually is almost impossible to scale as tracking more than 1 or 2 charts manually is impossible at real time. Instead, a program can be used to do this automatically. Such algos can be connected to a dataset to back-test the strategy across many stocks automatically. Algorithmic trading uses algorithms that follow a trend and defined set of instructions to perform a trade. The trade can generate revenue at an inhuman and enhanced speed and frequency. The characterized sets of trading guidelines that are passed on to the program are reliant upon timing, value, amount, or any mathematical model. Aside from profitable openings for the trader, algotrading renders the market more liquid and trading more precise by precluding the effect of human feelings on trading. Our project aims to further this revolution in the markets of tomorrow by providing an effective and efficient solution to overcome the drawbacks faced due to manual trading by building an Algorithmic Trading Bot which will automatically trade user strategies alongside its own algorithms for day-to-day trading based on different market conditions and user approach ,and throughout the course of the day invest and trade with continuous modifications to ensure the best trade turnover for the day while reducing the transaction cost, hence enabling huge profits for concerned users be it Organizations or individuals.

KEYWORDS: Technical indicator; Fundamental analysis; Algotrading; Latency; LSTM; ARIMA; RNN; Random Forest; KNN; Stocks; Equity

I. INTRODUCTION

Execution of trades on stock exchanges based on predefined criteria and without any human intervention using computer programs and software is called algorithmic trading or algotrading.Objective of the paper is to accomplish a user friendly and efficient dynamic web app for live price prediction andsignals.To implement and improve various already existing trading algorithms.To achieve higher accuracy and performance.To achieve lower levels of latency.To provide user with customizable and configurable settings for efficient trading. To discuss the results with experts/guide

The purpose is to provide a user-friendly application wherein investor can select a stock for live price predictions for different time periods and intervals. The application iscustomizable to the extent that it can predict the buy -sell signals of a particular stock and user can apply filters on live data.The transactions are high speed and take as little as 18 ms. It has grown tremendously in the past few years and in US almost 70% of overall trading volume is generated through algorithm trading. In India, the growth is still there and it accounts for almost 40% of overall trading volume.

Algo-trading is used in many forms of trading and investment activities, pension, funds, funds, insurance companiesuse algo-trading to purchase stocks in large quantities when they do not want to influence stock prices with discrete, large-volume investments. market makers (such as brokerage houses), speculators, and arbitrageurs—benefit from automated trade execution; in addition, algo-trading aids in creating sufficient liquidity forsellers in the market.

II. EXISTING SYSTEM

The existing systems usually charge high brokerage and are not transparent. They have high latencyand are barely customizable.

• **Latency**: Latency is the time-delay introduced in the movement of data points from oneapplication to the other. One needs to keep this latency to the lowest possible level to ensurethat we get the most updated information without a time gap.

• **Configurability and Customization**: Most algorithmic trading software offers standard built-in trade algorithms. Unless the software offers such customization of parameters, the tradermay be constrained by the built-ins fixed

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functionality. Whether buying orbuilding, the tradingsoftware should have a high degree of customization and configurability.

• **High cost and brokerage**: Most of the existing algo trading platforms charge a large sum foreach trade. The brokerages are so high that the profit margins for customers remains nil.

• **Mis-selling & Scams:** Risk management is critical with algorithmic trading. Back testedreturns shown that could potentially be manipulated to lure the customers. Every year SEBI comesup with regulations to be followed by traders and brokers to keep thetrading industry safe andrisk-controlled.

There are three conventional approaches for stock price prediction: technical analysis, traditional time series forecasting, and machine learning method. Earlier classical regression methods such as linear regression, polynomial regression, etc. were used to predict stock trends. Also, traditional statistical models which include exponential smoothing, moving average, and ARIMA makes their prediction linearly. Nowadays, Support Vector Machines (Cortes &Vapnik) (SVM) and Artificial Neural Networks (ANN) are widely used for the prediction of stock price movements. Every algorithm has its way of learning patterns and then predicting.

Table 1. Comparative Analysis of Various PredictionTechniques

AUTHORS	DATASET	TECHNIQUE	EVALUATION METRIC
WEN ET AL.	S&P 500	CNN USING MOTIF EXTRACTION	ACCURACY-56.14% PRECISION-55.44% RECALL-74.75%
HOSSAIN ET AL.SHAH ET AL.	BSE SENSEX	LSTM- GRU HYBRID	MSE- 0.00098 MAE- 0.023
ZHANG ET AL.	TA- LIB	RANDOM FOREST	ACCURACY-67.5% STD DEVIATION-3.7%
CREIGHTON ET AL.	S&P 500 AND S&P 400	ARIMA- BPNN HYBRID	MSE- 434.121 RMSE- 20.836 ACCURACY-45.1%
SELVIN ET AL	NSE	RNN, LSTM, CNN	MAE- 5.13% (RNN) 5.31% (LSTM) 4.98% (CNN)
SADIA ET AL.	KAGGLE DATASET	SVM, RANDOM FOREST	ACCURACY-78.7% (SVM) 80.8% (RANDOM FOREST)
MAINI ET AL.	DOW JONES INDUSTRIAL AVERAGE	DOW JONES INDUSTRIAL AVERAGE	ACCURACY-84.6% (SVM-LINEAR) 85.18% (SVM-RBF) 86.2% (RANDOM FOREST)
DEEPAK ET AL.	BSE SENSEX	SVM- RBF KERNEL	ACCURACY- 80 TO 85%
PERSIO ET AL.	GOOGLE ASSETS	RNN, LSTM, GRU	ACCURACY- 72%

III. METHODOLOGY

This paper aims to capture the live stock market data from the source using preexisting APIs and analyze the rise and fall in stock values in the previous years. It will then predict the expected market scenario in the future using relevant machine learning algorithms for better accuracy. The project will focus on the technical analysis segment that includes doing a statistical analysis of the data, understanding the charts and identifying the trends in the stock market.

Two approaches have been used in the project for stock market prediction: a KNN-RandomForest hybrid has been designed which combines neural networks with time forecasting series for capturing the linear and non- linear portion of the time series. Another forecasting library called Prophet designed by Facebook has also been used that handles the missing data and outliers uses intuitive parameters for optimal predictions.

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Finally, the algorithms are compared and the more accurate and less error prone algorithm is selected for future stock market prediction. The user can input the company's stock name whose predictions he wants to get. It will retrieve the stock's live data, apply the chosen machine learning algorithm, train the previous data and finally predict the expected future trend and stock values along with visualizations to the user.

The proposed methodology involves capturing the live stock market data using the yfinance API, developing the KNN-RandomForest , applying Prophet on the time series data, comparing the two algorithms to find an optimal solution and finally deploy it for the stock market prediction system. The steps have been described

One of the major challenges of this work is to capture live data while maintaining the accuracy to be high as well. There are various stock market data APIs that offer real-time data on financial assets that are currently being traded in the market. It is possible to retrieve the current prices and historical data of the public stocks with the help of these APIs. They can help generate some indicators which are crucial for monitoring the market and building trading strategies. Some of the most recent APIs which are active in 2019 are Yahoo's yfinance API, Googlefinance, iexfinance and world trading data.

This work uses the yfinance API of Yahoo to capture the live stock market data in OHCLV format. It gives the day's opening, closing, highest and lowest stock values along with the day's traded volume which is ultimately responsible for the volatility in the stock market. It is a standard API used by both individuals and enterprise level users as it provides reliable data of around the past 35 years and is easy and free to use.

IV. PROPOSED SOLUTION

Main problem in hand is to predict trading signals based on technical indicators using machine learning and implementing momentum trading strategy.

INPUT: Yahoo Finance and Alpha Vantage is used to fetch past data and put it into a dataset. The dataset comprises Date , Open Price , High Price , Low Price, etc for that particular stock.

OUTPUT: Based on user's selection , a date is given when to buy or sell these stocks.
Live-data will be fetched via an API,then Certain trends are confirmed. Along with earlier data, different sets of oscillators and indicators are applied to filter outstocks. Based on analysis as per defined strategies and back testing , user is given a date when tobuy or sell these stock

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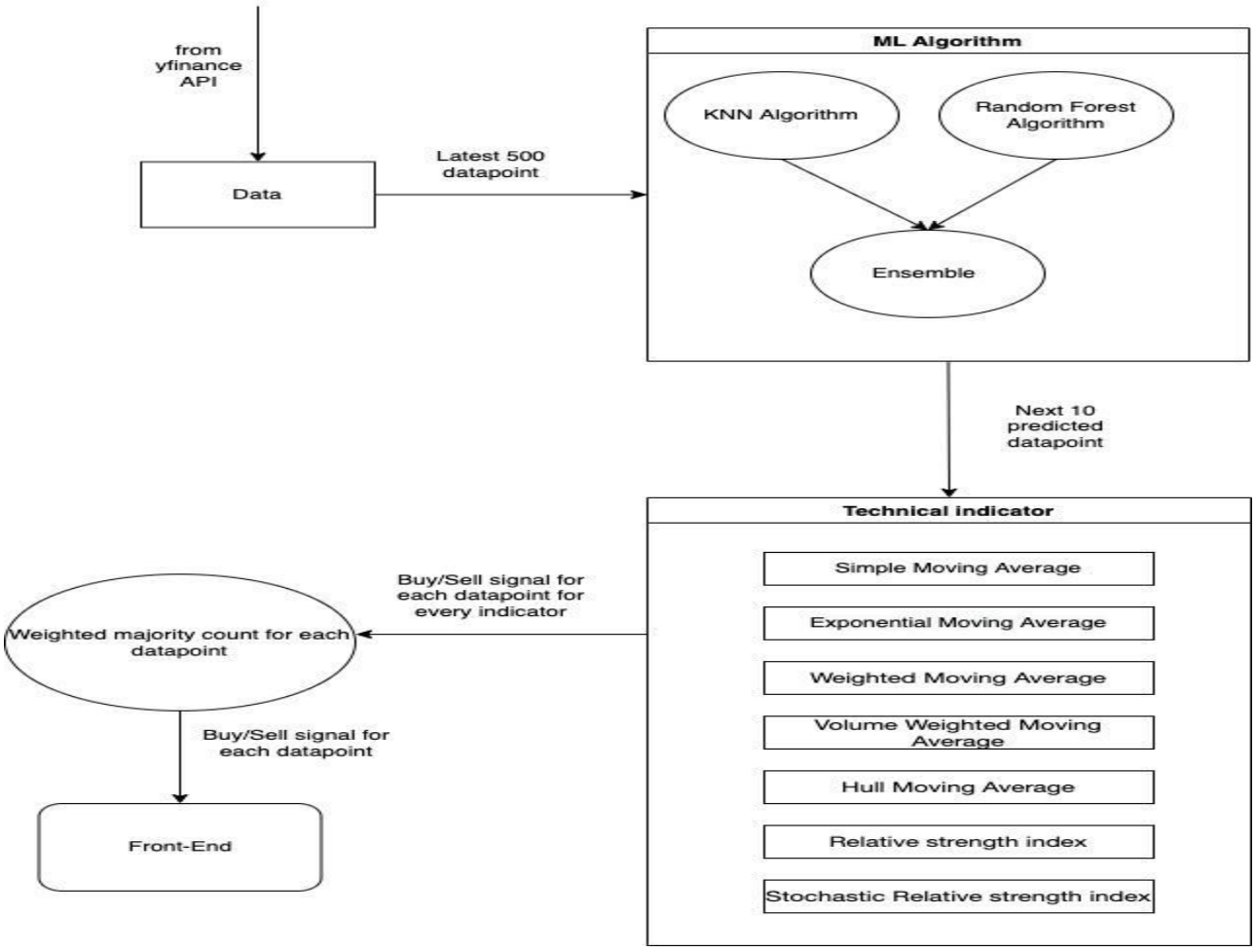

Fig. 1: System Design flowchart

Data: Stock data of a particular stock is collected from yahoo finance .This is the data using which the predictions are made. Latest 500 datapoints are collected. Data consist of date, opening price, closing price ,volume, highest price and lowest price

ML Algorithm: Two machine learning algorithms are used to predict the future closing price of the stock..The first one is KNN algorithm it is used because it is an instance based algorithm and is a bit baised towards close data points. The second algorithm used is Random Forest it compensate for the baiseness introduced by the KNN and it selected random data points for building decision tree. The output of these two algorithms are then used with the ensembled model to give the final predicted output.

Technical Indicators: The data from the yahoo finance and also the predicted datapoints are given to technical indicators to generate buy/sell signal. There are several technical indicators present some are based on volume some on closing price etc. Out of several indicators we are using 21 of them .Each technical indicator generate there own buy/sell signal. For the final output we are taking weighted average of the technical indicators. The weight of indicator is decided based on its accuracy and popularity.

V. PSEUDO CODE

Algorithm for Stock Price Prediction

Input: Stock prices from Yahoo finance
Output: Predicted value of stock price/portfolio

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Step 1:Import the Libraries..
Step 2: Load the Training Dataset..
Step 3: Use the Open Stock Price Column to Train Your Model.
Step 4: Normalizing the Dataset.
Step 5: split up the data into a train set and test set. Step 6: Create the KNN model
Step 7:Create the random forest model.
Step 8: create an ensemble model.
Step 10: Predicting the Value

Algorithm for Buy/Sell signal generation:
Input: Previous days stock price data and predicted price
Output: Buy/sell/Neutral signals
Steps1:Installing the Matplotlib and YFinance API and import the dependencies
Step 2:Choose a timeframe (a start and end date) and Ticker symbol.
Step 3: Run Technical indicators on the collected data
Step 4:Collect the signals generated by each technical indicator.
Step 5:Calculate weighted average for signals generated by all technical indicator
Step 6: Display the final output(Signal)

KNN algorithm :
1. Calculate "d(x, xi)" i =1, 2, ….., n; where d denotes the Euclidean distance between the points.
2. Arrange the calculated n Euclidean distances in non-decreasing order.
3. Let k be a +ve integer, take the first k distances from this sorted list.
4. Find those k-points corresponding to these k-distances. 5. Let ki denotes the number of points belonging to the I jth class among k points i.e. $k \geq 0$ 6. If ki >kj$\forall i \neq j$ then put x in class i.\

Random Forest Algorithm :
1. Randomly select "k" features from total "m" features.
    1. Where k << m
2. Among the "k" features, calculate the node "d" using the best split point.
3. Split the node into daughter nodes using the best split.
4. Repeat 1 to 3 steps until "l" number of nodes has been reached.
5. Build forest by repeating steps 1 to 4 for n number times to create "n" number of tree

VI. FLOWCHART

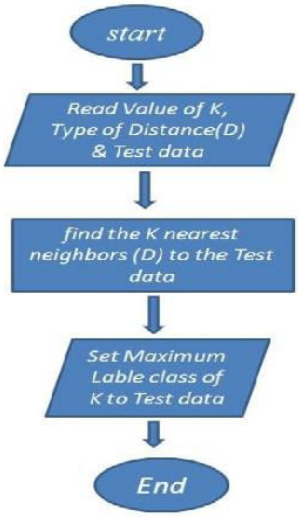

Fig 2, KNN flowchart

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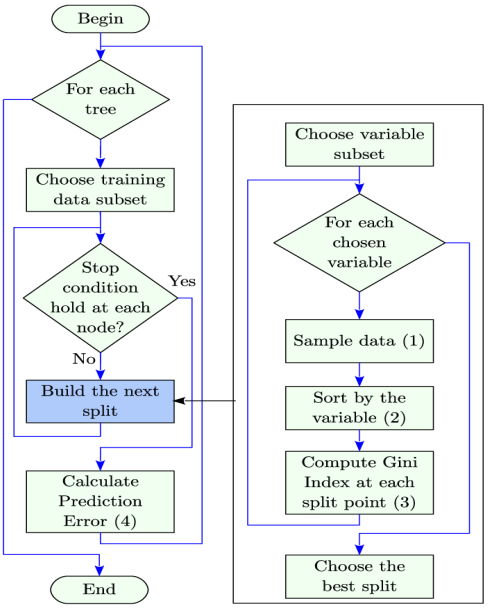

Fig 3, Random Forest Flowchart

VII. SIMULATION RESULT

Predict how the S&P500 will behave with our predictive model
Since this model is tuned to have a 15 day window, we need to feed in the input data with the days in the week of July 27th.

July 27th -> August 17th
July 28th -> August 18th
July 29th -> August 19th
July 30th -> August 20th
July 31st -> August 21st

Date	close	RSI	MACD	SIGNAL	14 period STOCH %K	MFV	14 period ATR	MOM	14 period MFI	ROC	...	OBV_y	20 period CCI	14 period EMV
2020-07-27	322.786162	62.241352	4.391348	4.265085	72.548453	4.703561e+11	4.447787	7.329364	77.681752	2.547333	...	3.528961e+10	57.078508	19.897446
2020-07-28	321.735666	56.472199	4.129935	4.238055	65.809537	4.703738e+11	4.391089	4.027777	71.670376	1.621396	...	3.523240e+10	50.953848	19.732249
2020-07-29	323.935480	64.436935	4.053543	4.201153	78.786355	4.704770e+11	4.242638	3.535215	78.862259	2.687747	...	3.528392e+10	66.832824	19.637692
2020-07-30	323.951412	64.491234	3.948768	4.150676	78.587058	4.706788e+11	4.174430	3.297814	72.547696	1.965178	...	3.534216e+10	55.464701	19.488042
2020-07-31	325.620987	70.024948	3.954865	4.111514	90.067492	4.710257e+11	3.998273	4.274227	72.205119	1.629438	...	3.541793e+10	70.253651	19.121452

Here are the five main days we are going to generate a prediction for.
The models predicts that the price will increase for each day.
Prediction with the actual results.
Results
July 27th : $ 322.78 — August 17th : $ 337.91
July 28th : $ 321.74 — August 18th : $ 338.64
July 29th : $ 323.93 — August 19th : $ 337.23
July 30th : $ 323.95 — August 20th : $ 338.28
July 31st : $ 325.62 — August 21st : $ 339.48

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As we can see from the actual results, we can confirm that the model was correct in all of its predictions. However, there are many factors that go into determining the stock price, so to say that the model will produce similar results every time is naive.

VIII. CONCLUSION AND FUTURE WORK

Algorithmic trading Bot not only provides Security, Cost, and Speed but is also a revolutionary technology for the future financial markets and economy. Algorithmic Trading Bot makes it easier for both new traders as well as established ones in getting profitable outcomes with minimized effort, time, and loss. The integration of Financial Knowledge with Machine Learning is a demand of future Trading and enhances both Performance and Revenue.

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